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A Study of the Impact of Globalization on Indiana's Manufacturing Industry

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ABSTRACT:

Globalization has often been perceived as the culprit in the decline of employment in several manufacturing industries in the U.S. The purpose of this research was to investigate how globalization affected the gas engine manufacturing and parts industry in Indiana during the period 1998-2008. Despite its relevance, this industry has experienced a tremendous decline in employment numbers and almost lost its presence in Indiana. For this study an anonymous online survey was conducted targeting individuals associated with this industry and holding positions in the areas of engineering and/or management. The survey addressed the areas of technology, education, globalization/competition and employment. However, only the area of education is presented in this article. The results found in this study contradict the common perception that offshoring is the main factor for the dislocation of workers in the manufacturing sector.

Keywords: Globalization, Outsourcing, Offshoring, Global Competition, Education, Competitiveness

1. Introduction:

There is strong discrepancy whether or not globalization and outsourcing are actually good for the economy of the country. Globalization, defined as the free movement of labor, capital and goods, has encountered strong opposition as well as equally strong support, among scholars and the general public. Globalization has been the enabler of open markets and consequently global competition conducted through outsourcing and offshoring. The term globalization is extensively used, but despite its frequent use there is no general consensus about its true meaning. Jovanovic posits that "globalization is defined in business schools as the production and distribution of products and services of a homogeneous type and quality on a worldwide basis" (Jovanovic, 2006). For some, globalization is connected strictly to the area of economics where it first was conceived. Over the last fifteen years globalization has become one of the most studied areas in social sciences, separating to some extent from its economic roots, and now embracing political and cultural aspects of human life. Some scholars even relate globalization to political science and in particular to the field of sociology (Caseli, 2008).

According to Venkatesan (1992), Quinn (1999) and (2000) and Quinn and Hilmer (1994) outsourcing has a more commonly accepted and established definition; it is referred to as allowing the performance of tasks by outside partners, that otherwise would be performed in-house as cited by Zhao and Calantone (2003). Similarly they define outsourcing as the means that allow firms to concentrate on a few tasks in order to provide unique and superior value to customers, protect and strengthen its core competencies, and retain or win competitive advantage in the marketplace. It gives the firm access to resources and capabilities that are not available or not easily developed internally. For Corbett (2003) outsourcing is "nothing more and nothing less than a management tool". In the early 80's outsourcing was referred to as the purchasing of manufactured goods from an outside firm, but in recent years outsourcing also comprises international trade in services bought abroad (Bhagwati, Panagariya, & Srinivasan, 2004).

Despite outsourcing's multiple definitions, it is believed that outsourcing improves the performance of business in areas that do not represent a core competency for the company, liberating capital and resources

for investments in areas that do (Corbett, 2003). Heshmati (2003) notes that outsourcing is the firm's response to import competition from low wage countries by moving non-skilled labor intensive activities abroad. Thus, outsourcing from the U.S. economy is generally for low-value jobs (Bhagwati, et al., 2004). A report published by Forrester Research and authored by John C. McCarthy (2004) states that the number of jobs lost to outsourcing would amount to 3.4 million by 2015; such a report can only increment the misconception of outsourcing, explains Bhagwati et al. (2004). Bhagwati argues the accuracy of such reports, since they fail to reveal that the U.S. economy lost around 30 million jobs in 2003, but created approximately as many as manifested by the Business Employment Dynamics survey of the Bureau of Labor statistics. Therefore they also exhort the American people to remember that any job losses in the country must be set against job gains obtained through outsourcing from other nations into the U.S. Through Foreign Direct Investment (FDI), foreign multinational's investment in the U.S. has created more than 5.4 million jobs by 2002, paying on average 31 percent higher wages than American companies (Slaughter, 2004).

The Commission of the European Communities (1993) as cited by Krugman and Venables, (1995) issued a White Paper stating that "the rise of Third World manufacturing nations has already had serious adverse impacts" for developed nations. According to Krugman (2000) if China continues to grow at 7 percent per year while the U. S. is growing at only 3 percent a year, China will have the world's largest economy by 2025. He also notes that developing countries, as a group, will eventually overtake the economic superiority of developed nations. This, he explains, is not that "America is doing something wrong, but because many other countries are also doing something right" (pg.175). Hagel (2004) is concerned that the U.S. is not producing as many engineers as other countries which, he says, could have devastating consequences for the competitiveness of the country. China is producing yearly 350,000 graduate engineers, compared to 90,000 in the U.S.; however, the level of education may not be outright comparable.

During the decades of 1960's and 1970's Americans feared that the rise of Japan as an economic superpower would become a threat to the American economy. Craig Barret, CEO of Intel (as cited in Bhagwati, et al., 2004), expressed his concerns about India and China soon having 300 million high skilled workers and the consequences this might have for the skilled worker within the American economy. Although the main outsourcing destinations for the U.S. continue to be China, India and Mexico, multinational corporations are seeking production opportunities in other Asian and Latin American countries. Bronfenbrenner and Luce's 2004 report to the U.S. China Economic and Security Review Commission revealed that there has been a major increment in the shift of production to the above mentioned countries. Hilsenrath (2004) argues that technology, and not trade, could have played the most important role in the loss of manufacturing jobs worldwide. Adbela and Segal (2007) predict that "the technological revolution that has driven the current wave of globalization will continue. Communication will become cheaper and easier, allowing corporations to spread their operations... around the planet" (pg 104). There are several factors mentioned as the motivators for the increasing trend in manufacturing mobility: cost reduction, cheaper labor, skills, market expansion, better technology and better systems.

Although companies are somewhat reluctant to publish numbers regarding their offshoring efforts, some estimate that by moving their operations to Asian countries, productivity has tripled (Hagel, 2004). Other reports show that the cost of moving manufacturing operations to China or India involve an increment of tangible and intangible cost that could be as high as 24 percent of the total product cost (Hogan, 2004). According to a survey conducted by the Nirupam Bajpai of the Earth Institute at Columbia University, 70 percent of the respondents stated that cost saving was the main reason for outsourcing followed by increased capacity, affordable labor and access to better technology (Smith, 2006). Trefler, as cited in Cheung, Rossiter, Yi, (2008) expands the list of motives for outsourcing by including access to a skilled workforce, expansion into growing markets and closer proximity to customers as principal motivators.

2. Need for the Study:

There is great discrepancy among scholars and the general public as to what the effects of globalization have

had for Americans, American businesses, and especially for the American worker. The manufacturing industry is often touted as the most negatively affected industry, but even here there is no consensus. Reports show indecisively that Americans benefit from globalization through affordable products manufactured abroad, while on the other hand, millions of jobs are outsourced and offshored to low wage countries, leaving workers without job opportunities. Both sides present evidence supporting their stances, but there is no general consensus. The Bureau of Labor Statistics (BLS) does not keep records of outsourced jobs, thus their positions cannot be confirmed or denied. Indiana has always been a manufacturing hub for the U.S. economy and the Midwest, and consequently it has also experienced the loss of manufacturing jobs in the region (Miller, 2005). Lack of evidence on the actual effects of globalization in the manufacturing industry leaves many questions unanswered. The purpose of this study is to assess the impact of globalization on the Gas Engine Manufacturing and Parts (GEM&P) industry during the time period 1998-2008 in order to determine whether globalization or technological improvements have caused the decline of employment opportunities in this industry. The industry selected for this research experiences strong global competition both from high wage and low wage countries and is thus considered appropriate for this study.

3. The Review of Literature:

There are two types of outsourcing, one that relates to labor intensive processes from which jobs are frequently outsourced to developing countries as a result of labor arbitrage; and outsourcing to industrialized countries in which the outsourcing nation benefits from advanced technologies or economies of scale. Despite the type, organizations that outsource enhance their profits in their home country (Cheung, et al., 2008). However, most of the turmoil around globalization is related to the outsourcing of labor-intensive tasks performed by low skilled workers to developing countries. The outsourcing of jobs to industrialized nations is a topic scarcely discussed by the media and unnoticed by the general public.

In 1995 the Bureau of Labor Statistics created a program called the Mass Layoff Statistics (MLS) with the purpose of tracking the reasons behind layoffs that affected large numbers of employees and also to assess the need for employment and training for the displaced workers. Since June 2004 the data collected nationally and by State has been published and for the first time it included questions about domestically and/or internationally “movement of work”. The MLS program asks for reasons behind the “movement of work” which targets directly the question whether or not the work was moved (or outsourced) out of, or within the United States. Outsourcing information is collected through employer interviews and identifies the economic reasons for the layoff, the affected workers, and possible reemployment opportunities. The relocation destinations mentioned frequently in the interviews were China and Mexico. Permanent closures were recorded for the following manufacturing industries: food, transportation equipment, electronic and computer products; these closures were due to reorganization. Company restructuring accounted for 20 percent of layoffs displacing almost 200,000 workers in the same year (Brown & Siegel, 2005).

Smith (2006) posits that offshoring has four substantial economic benefits for the outsourcing nation; first, it reduces costs (organizations save approximately 20 to 30 percent by moving their operations overseas) and through the flow of jobs abroad, inflation can be kept at lower levels. Second, and in direct contrast to popular belief, there is a substantial gain in real income (approximately 70 to 80 percent) in the form of lower prices enjoyed by the outsourcing nation. Third, countries having high unemployment usually have a shortage of labor in particular areas that can be covered with outsourcing. And finally, workers displaced by outsourcing can be moved up the value chain to higher value-added/higher productivity jobs.

However, Smith recognizes that there is no perfect mobility of labor and that frictions are likely to arise (Smith, 2006). According to Cheung et al. (2008) the gains of offshoring receive much less publicity due to the fact that they do not occur immediately and are difficult to associate with offshoring. Solomon deems that searching worldwide for personnel and production capability is not a new phenomenon, the only difference is that is happening at a much faster pace in an increasingly borderless marketplace (Solomon, 1999).

4. Education and manufacturing employment:

In 2008, when unemployment was at 5.6 percent, there were 3 million jobs vacant for over six months. These jobs were related to Science, Technology, Engineering and Mathematics (STEM) and required higher education skills. By 2009, unemployment rose to 9.4 percent and still there were over 3 million jobs available in the same areas. According to an analysis based on unemployment related to education, it was found that unemployment rates are negatively correlated with educational levels. Unemployment is higher among individuals lacking a high-school diploma (15 percent) compared to individuals with a bachelor's degree or further advanced education (4.8 percent). Edward E. Gordon (2009) states that recent school dropout rates at 30 percent levels is a serious deficiency in the American education system, and that "the picture of the U.S. economy that emerges is of abundance and poverty: abundance of labor, poverty of talent..." (p.35). Gordon also cites a survey conducted in 2005 in which American manufacturers expressed that holders of high-school diplomas are poorly prepared even for entry level positions. Thomas Friedman writes that: "...finally we are developing an education gap. Here is the dirty little secret that no C.E.O. wants to tell you: they are not just outsourcing to save on salary. They are doing it because they can often get better-skilled and more productive people than their American workers" (Friedman, 2005). On the other hand, Vivek Wadhwa an adjunct professor with the Pratt School of Engineering at Duke University wrote in a testimony to the U.S. House of Representatives in 2005 that the notion that the U.S. is producing fewer engineering graduates than China and India is erroneous. Wadhwa distinguishes between transactional and dynamic engineers and contends that dynamic engineers, those capable of abstract thinking and high level problem solving, globally rounded and having strong interpersonal skills will be in demand; transactional engineers, defined as those that possess engineering fundamentals and perform repetitive tasks will experience a decline in demand. Wadhwa suggests that engineers should also possess business education in order to address technical and business complex issues and that they should learn to think as entrepreneurs and innovators (Wadhwa, Rissing, & Gereffi, 2006).

In a report conducted in 2005, Wadhwa found that the statistics frequently cited regarding engineering graduates in India and China are inaccurate, despite the fact that these numbers are provided by the Chinese Ministry of Education and from reports provided by the National Association of Software and Service Companies in India. Wadhwa states that the statistics presented contain not only four year degrees, but also sub-baccalaureate degrees and certificate and diploma holders. According to this report, the U.S. awarded 134,406 bachelor degrees, India 112,000 and China 351,537 in 2004. Thus, there is no direct comparison with the accredited four-year engineering degrees statistics provided by the U.S. Another important factor is the quality of education, Wadhwa states that the quality of Chinese graduates is not close to the standards of U.S. graduates. Wadhwa sees a negative correlation between quality and quantity, with quality suffering at the expense of quantity. Barry Myers, a professor of Biomedical Engineering at Duke University states that "the quality of the students from the renowned Indian Institute of Technology (ITT) is as good as the average American student he teaches at Duke University" (Wadhwa, et al., 2006).

Thus, Wadhwa et al. (2006) foresee a shortage of dynamic engineers in China and India but foresees an abundance of transactional engineers. He warns that producing engineers without first studying the types of engineers that will be needed in the U.S. may have an adverse effect on the job market and lead to further unemployment.

According to the Indiana Department of Education (IDE) and the Outreach Committee Presentation prepared in February of 2010, the United States loses a high school student every 26 seconds, leading to more than 1.2 million high school dropouts every year (Indiana Department of Education, 2010). The Indiana Department of Education states that school dropouts affect the country's economy directly by lowering tax revenues in all states and by increasing the cost of social programs; it is estimated that over 25 to 30 years a dropout student can cost a community as much as \$500,000 in public assistance, health care and incarceration costs. Harlow (2003) states that it is noteworthy that state and federal prisons inmates

represent an overwhelmingly high population of school dropouts. In a study conducted by the Bureau of Justice Statistics in 2003 it was found that 75 percent of the country's state prison inmates are high school dropouts while federal prison inmates represent 59 percent of high school dropouts. In another study it was found that high school dropouts are 3.5 times more likely to be arrested than their counterparts that completed their school education. An increase of only 1 percent in graduation rates would save approximately \$1.4 billion in incarceration costs (Alliance for Excellent Education, 2006). Alli et al. (2007) posit that the modern industry is knowledge intensive and jobs will be created for the highly educated; although, it is unlikely that jobs will be generated for the uneducated. Thus, "technology comes from but one place- education. The primary way to accept (or fight it) globalization is through knowledge" (Alli, et al., 2007). Fisher (2004) states that the primary cause of decline in employment in manufacturing is due to technological advances. Miller supports Fisher's position, stating that the primary driver of the decline in manufacturing employment is increased productivity, which allows manufacturers to increase an additional unit of output with fewer workers; this he says, is the "cause and the cure" for the decline in manufacturing employment (Miller, 2005).

Manufacturing jobs have been especially important for those without education or formal training beyond high school (Miller, 2005). In a report prepared for the Indiana Chamber of Commerce Foundation, it was found that the U.S. has serious workplace skills problems; in the nation approximately 50 percent of adults have low literacy (Futureworks, 2005). In the 21st century, 60 percent of all jobs will require skills that are possessed only by 20 percent of the current workforce (Futureworks, 2005).

Walter explains that John Howard, Director of the National Institute for Occupational Safety and Health sees a shift in the pattern of employment and that college education might not be the key to future employment. He states that from 2010 to 2020 around 30 percent of Americans in their 20s will work towards a college degree, but only 60 percent of future jobs will require a degree (Walter, 2010). Alli (Alli, et al., 2007) states that the most fundamental lesson from the globalization of markets is that the education and skills of the work force and managers are the dominant firm's competitive weapons (pg. 94). Wadhwa posits that competitiveness is a function of the graduation rates of engineers and scientist; ... "Reality: It is all about age, workforce education and skills" (Wadhwa, 2011)

The disappearance of manufacturing jobs in the US is leaving manufacturing workers unemployed, and the media usually contends this as the result of globalization. The educational level of manufacturing workers in the area seems to be another factor contributing to their unemployability in an economy that seeks to implement technology in order to remain competitive in the global market. However, there is still discrepancy whether globalization, technological improvements or education are causing the decline in employment in this industry.

5. The Study:

To uncover the effects of globalization an online survey was conducted targeting the industry selected and the Indiana Chamber of Commerce, the Engine Manufacturers Association and the Society of Manufacturing Engineers. The selected companies were operating under NAICS 336312. The participants were asked to assess the effects of globalization as experienced by them in their respective organizations and within their industry. The participants were also asked to give insight about the broad skills set required from future manufacturing workers to secure the stability and subsistence of this industry in the U.S.

Internal validity, the extent to which the design and the data yields allow the researcher to draw accurate conclusions about the cause and effect and other relationships within the data (Leedy & Ormrod, 2010) was achieved by approaching four professors at different universities and one PhD Candidate at Indiana State University. These individuals were considered knowledgeable and with substantial expertise in the area of

research. For the validation process the survey questionnaire was sent electronically to this group of experts who were expedient in providing feedback and improvements to the questionnaire.

5.1 The Results of the Study:

The results of this research sought to understand or explain how globalization had affected the industry under study. The repeatability of the study suggest that if the same questions were asked to a similar set of respondents then similar answers would be gathered. The requirement to be considered as participant in this study was that the interviewee must have at least 2 years of industry working experience and 3 years for all non-industry specific positions. The participants were requested to share their knowledge and experience in the area of globalization and employment by providing their views about the present and future of this industry. They also were asked to give insight about potential factors that could help manufacturing workers to compete in a globalized world as well as their opinion about the broad skills set that future manufacturing workers may possess to secure their work in this globally challenged industry.

The knowledge gained from this study can help identify any negative factors affecting this industry in order to ameliorate these factors and allow this manufacturing sector some insight toward a possible improvement. As also found in the review of literature, there is a correlation between educational achievement and job security palpable in this industry as well. The higher the educational level of the individual the less affected they are by the introduction of i.e. new technology. Half of the respondents agree that automated manufacturing processes will replace less skilled workers. Thus, based on these results and in the review of literature it can be concluded that new technology will continue to dislocate primarily low skilled and unskilled workers, while holders of higher degrees will not be as affected in the same proportion.

The survey inquired further whether or not the skill set of the workforce at the time of the implementation was sufficient to deal with the new technology. Half of the respondents were unsure about this fact while 29 percent considered that the skill set of the workers at the time of the implementation was not sufficient to deal with the new technology. Only 21 percent considered that their current workforce could manage the new technology without further changes on employment rates. The respondent's state that the lack of skills encountered resulted on the other hand, in the positive fact of hiring new skilled workers. From the answers gathered it could be deduced that automation is equally destroying as well as creating employment opportunities. Less skilled workers are being replaced by technology and automation. These machines require knowledge and expertise that can be provided by high-skilled workers only, who were not previously present on the manufacturing floor.

Thus, it can be concluded that the face of the manufacturing industry is changing from labor-intensive production processes to knowledge intensive and high tech. Fewer workers will be needed on the production floor while productivity will continue to increase. The respondents agreed unanimously that in the future there will be a shortage of a qualified workforce and that this will lead to other nations surpassing and even coming to dominate manufacturing areas in which the U.S. used to lead. Half of the respondents glimpse a seemingly difficult future for the U.S. manufacturing industry and believe that the American manufacturing industry may even disappear to the benefit of foreign competitors.

The survey explored the area of education as a competitive factor in the global arena. Eighty seven percent of the respondents consider that education in the areas of mathematics and science are extremely important to withstand competition and technological advances from foreign competition. Eighty percent of the respondents consider that current manufacturing workers need to improve their skills in primarily technical areas. Seventy three percent of the respondents consider interpersonal skills as an important factor while 47 percent deemed business knowledge an important area that needs improvement. Technical competitiveness is undoubtedly the major competitive factor in the area of education. The shortage of a qualified workforce was often mentioned in the review of literature as a major problem in the manufacturing industry. Thus, the

survey investigated further where this industry finds currently the workforce they need. The respondents state that manufacturing workers are mostly found at:

- 2-year technical colleges and Universities
- Engineering departments
- Unemployed experienced workers
- Current workers working for competitors
- Hands-on experienced workers
- Workers must be trained on site

The survey questionnaire explored whether higher education was relevant for technical competency and global competitiveness. The results show that 75 percent of the respondents agree that certifications provided by industrial organizations and 2-year technical colleges provide the necessary skills and knowledge required for this industry.

Sixty percent of respondents state that university studies at the Bachelor's level provide the technical education required. Advanced degrees at Master's and Doctoral levels are deemed less relevant for this industry. The review of literature discussed the fact that in the 21st century, most of the jobs will require skills that are possessed only by 20 percent of the current workforce and that many of those jobs are in areas still unknown to us. Certainly, technological improvements are also requiring more sophisticated skills that may have not been created yet.

The educational level of the manufacturing workforce in the area is considered scarce. Employees with low or no formal education seem to be mostly affected by the introduction of new technology in the manufacturing floor. The introduction of technology in the manufacturing process is displacing low skilled workers. However, the respondents deemed globalization as the main responsible for any negative impact suffered on employment rates in this industry and not educational achievements by the domestic workforce.

6. Conclusion:

This study sought primarily to understand the effects of globalization on the gas engine manufacturing and parts industry in Indiana as experienced by those individuals working in this industry. The responses obtained in the survey showed divergence of experience in some areas while others seemed to have more commonality. However, the results gathered in this study were valuable in bringing some understanding to how globalization and technology have impacted this industry in Indiana. The results show that employees with no formal education or scarce education were mostly affected by the introduction of new technology. Low skilled and unskilled workers seemed to be the first employee category to be replaced by equipment when automation was brought into the manufacturing floor. The majority of respondents considered increased competition as one of the major drawbacks of globalization. They also stated that globalization was, according to their knowledge and experience, the main responsible for the decline in employment opportunities in this industry. The results of the survey showed that employment security and education are correlated; a workforce that possesses higher education and technological skills is less at risk of being replaced with automation.

There was consensus among the respondents about the fact that, in the future, the U.S. will experience a shortage of a qualified workforce. This situation may give other nations a dominating manufacturing position in areas where the U.S. used to excel. The majority of respondents affirmed that the increasing number of student dropouts from the school system and the scarce availability of a knowledgeable workforce are creating substantial problems for this industry. The respondents stated that education in the areas of science and mathematics was extremely important to withstand competition, and also that the current school system was not providing the basic skills required to secure a job in this industry. The vast majority stated that the workers in this industry needed to improve their technical skills, followed closely by interpersonal skills.

At this time business knowledge and entrepreneurial thinking were not considered relevant. Technical knowledge was considered by far the number one competitive tool for this industry. The respondents stated that certifications provided by industrial organizations and 2 year colleges bestowed future manufacturing workers with the skills and competencies necessary in this industry.

Despite the theories that anticipate the U.S. manufacturing industry will succumb to the advantage of developing nations, this industry can still constitute one of the main pillars of the nation's economy. The results of this exploratory research demonstrate that the perception of the manufacturing industry under study is similar to that of the opinion of the general public. The fact that globalization enhances competition should be regarded as a means to further development and discovery and raise the bar by which U.S. companies need to perform in order to compete globally. Indiana and U.S manufacturers alike are, as a result, pushed to continuously improve their production process and become more efficient in order to remain competitive in a globalized world.

Globalization is certainly putting Indiana's manufacturing to the test. This industry is facing real challenges with competition and workforce issues. This competition is not exclusively associated with foreign competitors and products manufactured abroad; it is the daily struggle of trying to attract future workers to an industry that is tainted by the old image of Henry Ford's assembly line. Oftentimes manufacturing jobs are portrayed by layoffs, the offshoring of jobs to developing countries and unsanitary working conditions. The manufacturing industry's image has been regarded by many as its own worst enemy. If the manufacturing industry is to survive, great effort should be dedicated to depart from this dated image and promote manufacturing as the exciting industry it actually is; an industry that has certainly reinvented itself as high tech in the 21st century. The industry itself, but also trade schools and universities, have the responsibility to make this "face lift" possible and make it known. Future manufacturing workers must first be reassured that there is job security and potential for growth in this industry. The United States Department of Labor provides a countrywide and state specific apprenticeship sponsor programs that could be utilized to spark the interest of potential students in technical related areas necessary in this industry. On the job apprenticeships provide hands on experience and successful students are usually employed by the sponsoring company.

However, the scarcity of a qualified workforce deters investment in capital goods since current manufacturing workers lack the technical skills required to deal with new technology. In order to overcome this obstacle and mitigate the effects of globalization, education in technical areas is necessary. It is the accessibility of a knowledgeable workforce that will decide the future of the manufacturing industry in general, and this industry in particular. The lack of a knowledgeable workforce will continue to push the manufacturing industry to become more automated and to increasingly rescind from their need of labor, or it will force them to offshore when qualified domestic labor becomes unavailable. The only way to withstand competition is through education. Without an educated workforce no industry will be able to survive, and our world will become with or without us "One World Ready Or Not" as Greider (1997) once stated.

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